High-Tech Spying

On Livestock

The feds pull up in a surveillance van and park in a nearby alley. Walking carefully in the dark, they place a special, remote-controlled camera on a 12-foot-tall tripod. From inside the van, they use a joystick to turn the camera almost 360 degrees, to zoom in and pick out individuals in the nighttime crowd. They can also look out the trailer's windows with the latest generation of night-vision scopes—or use them to spy from the security of a platform on top of the van. They still find it difficult to pick out a dozen or so suspects from the hundreds in the crowd.

They've tried marking them with the same tape and paint used to mark vehicles of friendly forces in combat. The coded symbols made with the tape or paint are then visible under infrared lights.

But the tape doesn't stick to their bodies, and the paint raised safety concerns over the long run.

These feds aren't in a military—or even police—operation. Instead, they're a U.S. Department of Agriculture team of farm animal behaviorists in action. Their "suspects" are individual cattle in a herd they are observing at a commercial feedlot in the Texas Panhandle—the feedlot capital of America, if not the world.

Julie Morrow-Tesch has set up livestock behavior studies units at West Lafayette, Indiana, and at Lubbock, Texas, for USDA's Agricultural Research Service (ARS). She is one of a handful of farm animal behaviorists in the country. Another is Don Lay, formerly at Iowa State University and recently hired to lead the West Lafayette unit. Soon his unit will be hiring a swine behaviorist.

These hires are part of ARS' research drive to find objective ways of measuring stress in farm animals to improve animal handling practices.

"The stresses we're talking about can cause real problems—slower growth, illness, injury, and sometimes death to livestock," Morrow-Tesch says. "Besides the humane concerns, we're talking about stresses that cost real money in reduced production. Just as an indicator of the costs involved, increasing survival by just one piglet per litter can provide the livestock industry an extra $100 million or more in sales. And that doesn't include the savings that can come from better quality meat, faster growth, bigger animals, and less use of medicine and veterinary services."

Morrow-Tesch and colleagues bring the mobile lab to the large outdoor feedlots for a 24-hour surveillance once each season, year-round. They use the remote camera or sit on the van's roof platform to observe, using binoculars by day and night-vision scopes by night. They check on the behavior of individual cattle every 15 minutes.

There are 200 to 250 head of cattle in each 100-by-100-foot pen. Morrow-Tesch can survey several of the side-by-side pens from the mobile lab.

SCOTT BAUER (K9443-1)

Atop a mobile animal-surveillance laboratory, technician Adam Lewis and support scientist Jeff Dailey record data on animal behavior. This laboratory on wheels is equipped with remote-controlled cameras and night-vision scopes so the animals can be observed 24 hours a day.

The feedlot research has already shown that feeding the animals at dusk instead of mainly at dawn significantly cuts down on animal roughhousing and attendant injuries.

ADAM LEWIS (K9458-1)

Postdoctoral research associate Frank Mitloehner, of Texas Tech University, places an identification mark on a steer to help keep track of the animal during observation.

The mobile lab keeps her out of sight of the cattle, and the cattle are used to the van being present. The night-vision scopes are used to avoid the need for bright lights that could distract cattle. All the surveillance is designed to be discreet, so cattle can be observed in a normal setting.

The feedlot research has already shown that feeding the animals at dusk instead of mainly at dawn significantly cuts down on animal roughhousing and attendant injuries. "We noticed that switching the main meal from morning to just before sunset cut the number of aggressive incidents by almost half," Morrow-Tesch says.

These observations convinced her that animals were less restless when their main meal was at night rather than at dawn. It seemed that if they couldn't indulge their instinctive desire to munch at dusk, they looked for other activities. These include mounting, or bulling, and just plain bullying—pushing and shoving.

"When we recorded the frequency and duration of this type of behavior, we saw a definite change for the better when they were fed at dusk," Morrow-Tesch says.

For the study, Morrow-Tesch and her colleagues—ARS technicians and Texas Tech students—recorded the following behaviors: feeding, drinking, standing, lying, walking, aggression, bulling, and socializing. They observed a total of 5,565 steers in 31 pens.

Injuries from the bulling behavior cost feedlots an average of $70 a head. And that figure doesn't include injuries from other aggressive behaviors or the dust kicked up by the extra activity.

"As a measure of stress, behavior is critical to our studies in commercial feedlots," Morrow-Tesch explains. "We can't go to these feedlots and take weekly blood samples to look for stress indicators as we do in the lab. Here we have to use noninvasive detection methods, so observing behavior is the best way we can do that. The characterization of the behavior of feedlot cattle in West Texas has never been done before. This is applied research in a commercial setting. It requires a high level of cooperation between the feedlot owners and operators and researchers. Plus we had to develop the techniques for observing the undisturbed behavior of commercial cattle over a 24-hour period."

It is only through such voluntary cooperation that Morrow-Tesch can analyze a feedlot's production records for data that will put her findings in the context of practical economics.

"For example, our next task in this study is to analyze industry data and see if it makes economic sense to add a new shift of workers to feed the cattle in the evening," she says.

Another of her feedlot studies showed the value of shading cattle over misting them to cool them on hot days. The study was done with 80 feedlot heifers. The shaded heifers reached their market weight 20 days earlier than unshaded heifers and

were about 60 pounds heavier at slaughter. The results need to be analyzed to see if it would be practical to build shade roofs to reduce production losses due to heat stress.

The Long Road to Market

Another concern of Morrow-Tesch's is the growing practice of shipping week-old piglets to other production facilities.

"These piglets are traveling great distances—like from North Carolina to the Midwest—and we're wondering if this has any harmful effects on them," says Morrow-Tesch.

To find out, last spring she began shipping piglets in trucks specially equipped for—you guessed it—surveillance.

"We shipped piglets from Lubbock to the Lamar, Colorado, area and on the return trip brought back adult hogs ready for slaughter," she says. "It's more difficult to measure behavior when transporting fully grown pigs than piglets because they're taller. The camera is closer to them, so we had to change to a wide-angle lens to view them all. Plus, when they stand on each other they can bite the camera if we don't have it up high enough. It took us many practice runs to get everything right," she says. "We also had to keep the cameras from rattling around in the trucks."

Morrow-Tesch has the trucks equipped with sensors to record air temperature and humidity in the area where the pigs ride. She and her colleagues take blood samples before and after each trip, looking for biochemical changes in levels of cortisol and other hormones or chemicals that may be indicators of the animals' stress levels. "We hope to eventually have a sensor that records road vibrations, too," she adds.

Psychological Stresses

So far the researchers have clues suggesting that it may not be the long truck ride and road vibrations stressing piglets as much as the attendant isolation during the trip. They found this in a study of piglets from eight litters. They isolated male and female piglets aged 7 to 10 days old in a holding area for the same amount of time as piglets that were transported. The isolated piglets lost more weight than the transported piglets, and their glucose levels were lower.

"This is one of many examples in which it seems that psychological stresses are worse than such physical stresses as mildly higher or cooler temperatures or road vibrations," Morrow-Tesch says.

"We are building on knowledge of stress developed since the 1930s. One example is the fight-or-flight response, where stress can cause higher blood levels of adrenalin that can be damaging," she says.

In their studies to date, the scientists have verified and added to knowledge about swine immune responses to stress.

"We need to develop an up-to-date stress model for livestock," she says, "one that uses the new knowledge that

SCOTT BAUER (K9445-1)

Technician Adam Lewis (left) and support scientist Jeff Dailey connect video equipment to record sow and piglet behavior in a traditional indoor farrowing environment.

SCOTT BAUER (K9441-1)

SCOTT BAUER (K9444-1)

On an icy cold day at the Sustainable Pork Farm east of Texas Tech University, research assistant Anna Johnson, of Texas Tech, secures a video camera on top of a farrowing hut to monitor the behavior of the sow and piglets inside. The huts are part of a sustainable production system developed by university animal scientist John McGlone. In this system the animals roam freely and are not treated with antibiotics, yet they are healthier than those raised in conventional indoor systems.

SCOTT BAUER (K9442-1)

At Texas Tech University, research assistants Anna Johnson and Harold Rachuonyo observe the behavior of a sow and her litter inside a farrowing hut.

farm animal behaviorists are developing. This model will save a lot of wear and tear on livestock handlers, as well as livestock. And that translates into higher efficiency and profits, healthier and happier animals, and possibly a safer food supply for people."

In the future, Morrow-Tesch says she and her colleagues will study the effects of stress on behavior, physiology, microbiology, and production. In one study soon to be under way, Morrow-Tesch and colleagues will artificially manipulate stress hormones produced in the brains of pigs, as a model of stress.

"We'll then be able to identify how stress affects behavior, immune response, and pathogen levels in these animals."—By **Don Comis,** ARS.

This research is part of Animal Well-Being and Stress Control Systems, an ARS National Program (#105) described on the World Wide Web at http://www.nps.ars.usda.gov.

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